

sea level. This is contrary to measurements of the diameters of dust particles collected by means of an Owens dust counter by Mr. Hand during airplane flights up to 10,000 feet. It must be remembered, however, that in general such dust as is present in the atmosphere at a place like Calama, Chile; for example, is principally of local surface origin, and should not differ in size from surface dust at sea level.

Ångström's determinations fix the average diameter of atmospheric dust particles under normal conditions at about 1 micron, and indicate a considerable increase in diameter in August, 1912, when the source of the dust was principally the explosive eruption of Katmai Volcano in Alaska. From the width and angular dimensions of Bishop's ring, which has been shown to result from the diffraction of light by volcanic dust, the diameter of these dust particles has been computed to be 1.85 microns.

Ångström also finds that the variation in the value of  $\beta$  with height may be expressed by the equation  $\beta_h = \beta_0 e^{-\delta \times h}$  where  $\delta = 0.69 \times 10^{-5}$ ; and, similarly, that the vertical variation in the number of atmospheric dust particles, as determined by Hand's measurements, may be expressed by the equation  $N_h = N_0 e^{-\phi \times h}$ , where  $\phi = 0.7 \times 10^{-5}$ . It will be noted that the exponent of  $e$  in the two equations is practically the same.

Adopting for  $\beta_0$  and  $N_0$  the values 0.094 and 400, respectively, or approximately the mean of their respective values for Washington and Upsala, Ångström derives for  $\Sigma N$ , the number of particles in a vertical column 1 square centimeter in cross section, the value  $5.6 \times 10^7$ . He also derives the general expression  $\beta = 1.79 \times 10^{-9} \Sigma N$ . From this latter the monthly mean values of  $\beta$  have been computed for Washington. They show a marked annual variation, with a maximum of 0.157 in May and a minimum value of 0.051 in November and December. As the author states, this does not agree with the annual variation in the number of dust particles found at the surface; but when we consider the probable value of the monthly means of  $\Sigma N$  we must take into account the difference in vertical distribution found by airplane measurements in August and November. Therefore, since convection is most active in late spring and early summer, and least active in late fall and early winter, there is nothing incongruous in the annual variation of  $\beta$ .

Summarizing, a more accurate way seems to have been found for computing the solar-spectrum energy distribution at the bottom of the atmosphere, except in the ultra-violet, where actual measurements are required. Also, the size of the dust particles as indicated by the value of  $\alpha$  should be a clue to their source. For example, dust particles of volcanic origin appear to be larger than dust particles from the surface of the ground, while cosmical dust particles, which are thought to have been observed at times of sunspot maxima, probably are smaller.

551.524 (048) (215-17)

*Temperature distribution up to 25 kilometers over the Northern Hemisphere.*—K. R. Ramanathan, meteorological department, Poona, India, has published in Nature (London), June 1, 1929, a very interesting chart showing the distribution of temperature up to 25 kilometers over the Northern Hemisphere for summer and winter. (Fig. 1.) The broken lines (except that for 0° C.), the author states:

Are based on very few observations, and are therefore mainly conjectural. The principal features of the diagram may be briefly summarized.

(1) The stratosphere is not isothermal over any particular place, but above a certain level there is a tendency for the temperature to increase with height.

(2) The coldest air over the earth, of temperature about 185° A., lies at a height of some 17 geodynamic kilometers<sup>1</sup> over the Equator in the form of a flat ring surrounded by rings of warmer air.

(3) The surface of the tropopause has a relatively steep slope toward the pole between latitudes 30° and 50° in summer and between 25° and 45° in winter.

(4) The ring of lowest temperature at the tropopause is displaced toward the summer hemisphere.

(5) There is a ridge of high temperature in the tropopause between latitudes 20° and 40° north in summer corresponding to the ridge of high pressure at 8 kilometers over those latitudes. (See Sir Napier Shaw's chart of 8 kilometers isobars in July, Manual of Meteorology, vol. 2, p. 262.)

A comparison of this chart has been made (by the reviewer) with the results of some recent aerological observations made in this country which were not included in the data comprising the chart. The average height and temperature of the tropopause as determined from a sounding balloon series made at Royal Center, Ind., in May, 1926, and at Groesbeck, Tex., in October, 1927, are

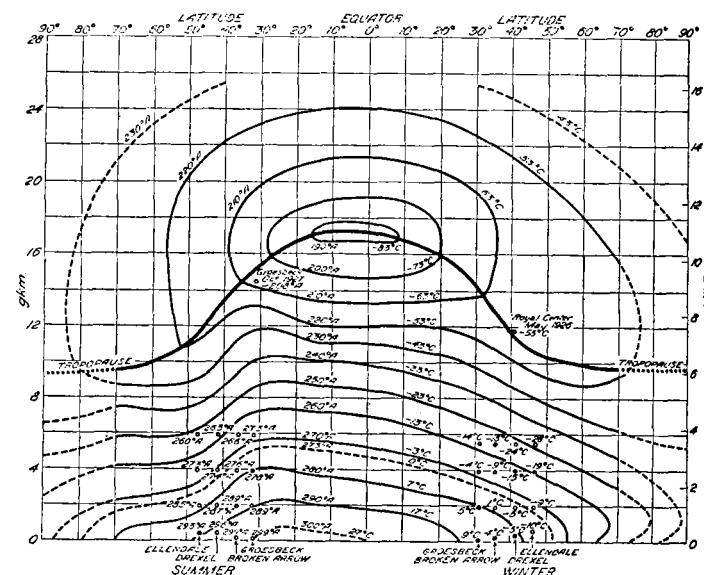


FIGURE 1.—Distribution of temperature up to 25 kilometers over the Northern Hemisphere

found to be in close agreement with the data depicted. These values are indicated at the corresponding points on the chart.

There are also indicated for comparison purposes the average temperatures at various heights as determined for summer and winter from kite observations made at four aerological stations in the United States, viz., Ellendale, N. Dak., latitude 45° 59'; Drexel, Nebr., latitude 41° 20'; Broken Arrow, Okla., latitude 36° 02', and Groesbeck, Tex., latitude 31° 30'. While all of the latter do not coincide with the smoothed isotherms of the diagram, the general agreement is good, and the differences found are undoubtedly real and due to the greater extremes in temperature found in continental United States as compared to Europe.—L. T. Samuels 546.214 (048)

*How high is the ozone layer?*—By Charles Fitzhugh Talman.—For many years it has been known that a relatively large amount of ozone is present at high levels

<sup>1</sup> The following quotation from Manual of Meteorology, Volume 2, p. xx, by Sir Napier Shaw, will explain what is meant by geodynamic kilometers: "There is a good deal of laxity about the use of the word height, of the same kind as that of the aeronauts who graduate a pressure instrument to read what they call height. For example, V. Bjerknes and others would express the height of a point in the atmosphere by the geopotential at the point, calling the quantity expressed the dynamic height. We reproduce from the *Avant Propos* of the *Comptes rendus des jours internationaux*, 1923: 'The relation of the geopotential at any position to the geometric height of that position  $h$  and the gravitational acceleration  $g$  is  $h = \int g dh$ . The value is governed accordingly by the local value of gravity depending on the attraction of gravitation and the rotation of the earth, but not to any appreciable extent upon the condition of the atmosphere at the time of observation.'